BCEE345/4V Assignment 1. Solution

$SDL = 8\,kN/m$

$LL = 10\,kN$

$SL = 5.5\,kN/m$

1. Beam Self Weight: (1 point)

$$SW = 24 \times (0.95 \times 0.25 + 0.4 \times 0.4) = 9.54\,kN/m$$

$$\therefore \text{TOTAL DL} = 8 + 9.54 = 17.54\,kN/m$$

2. Max. Moment: (3 points) ⓐ Middle span

$$M_{max} = \frac{wl^2}{8} \text{ or } \frac{PL}{4}$$

$$M_{DL} = \frac{17.54 \times 10^2}{8} = 219.25\,kN\cdot m$$

$$M_{LL} = \frac{10 \times 10}{4} = 25\,kN\cdot m$$

$$M_{SL} = \frac{5.5 \times 10^2}{8} = 68.75\,kN\cdot m$$

3. Max. Shear: (3 points) ⓐ support

$$V_{max} = \frac{wl}{2} \text{ or } \frac{P}{2}$$

$$V_{DL} = \frac{17.54 \times 10}{2} = 87.7\,kN$$

$$V_{LL} = \frac{10}{2} = 5\,kN$$

$$V_{SL} = \frac{5.5 \times 10}{2} = 27.5\,kN$$

4. Load Combination

① Moment: (1.5 points)

$$1.4M_{DL} = 1.4 \times 219.25 = 306.95\,kN\cdot m$$

$$1.25M_{DL} + 1.5M_{LL} + 0.5M_{SL}$$
$$= 1.25 \times 219.25 + 1.5 \times 25 + 0.5 \times 68.75 = 345.9\,kN\cdot m$$

$$1.25M_{DL} + 1.5M_{SL} + 0.5M_{LL}$$
$$= 1.25 \times 219.25 + 1.5 \times 68.75 + 0.5 \times 25 = \underline{389.7\,kN\cdot m}$$

control

⑤ Shear: (1.5 points)

$1.4V_{DL} = 1.4 \times 87.7 = 122.8\ kN$

$1.25V_{DL} + 1.5V_{LL} + 0.5V_{SL}$

$= 1.25 \times 87.7 + 1.5 \times 5 + 0.5 \times 27.5 = 130.9\ kN$

$1.25V_{DL} + 1.5V_{SL} + 0.5V_{LL}$

$= 1.25 \times 87.7 + 1.5 \times 27.5 + 0.5 \times 5 = \underline{153.4\ kN}$

Control.